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Levee Monitoring and Early Warning System

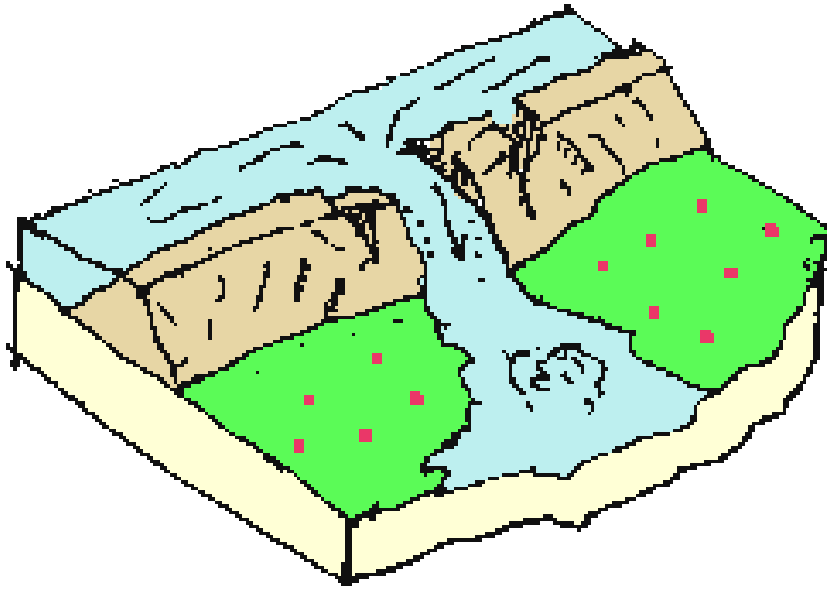
SACE 2008 Planning Community of Practice Conferenc
20-22 May 2008
San Antonio, TX

Purpose

Investigate innovative technologies for the detection and early warning of impending levee or dam failure using spatially continuous real-time monitoring of subsurface changes in a levee:

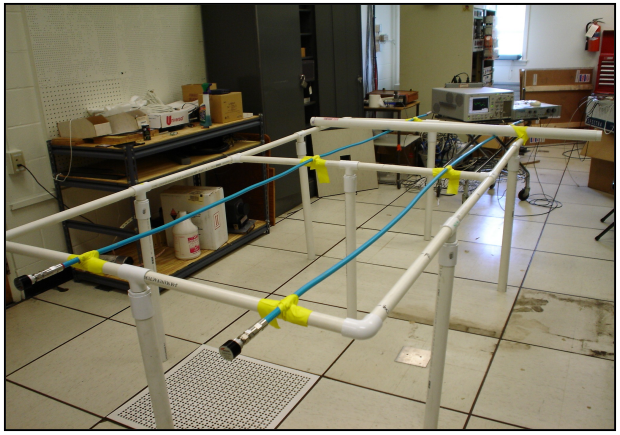
Localized moisture changes

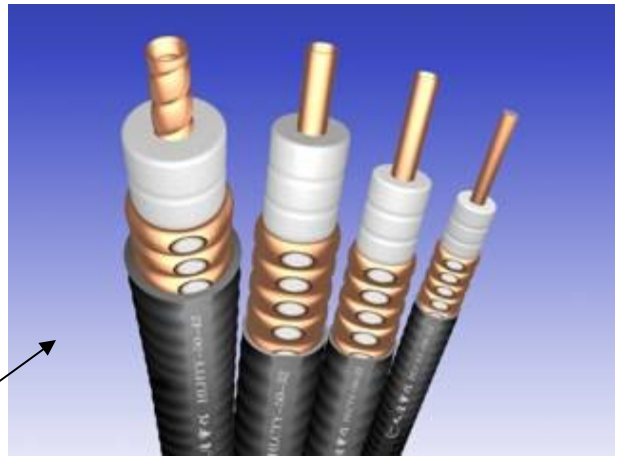
Displacement



The Development of a Remote Levee Monitoring System Using Ported Cable

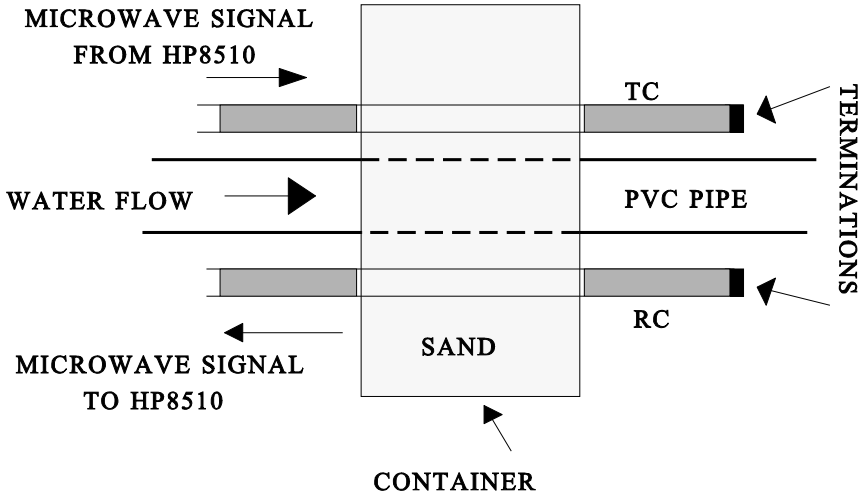
- Lab Tests
  - Testing of ported cables
  - Understand how they work
  - Reference signals in air medium





The Ported Cable is a Common Product that is Commercially Available

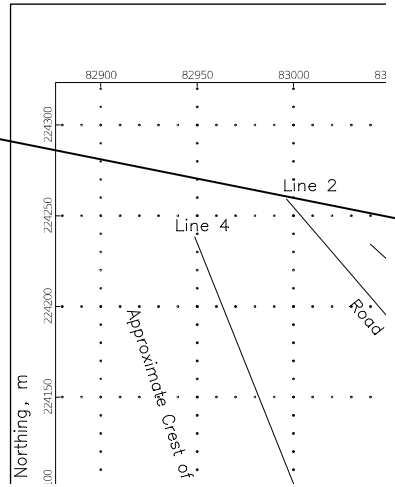
Early Tests in 1997 Establishing Sensitivity of Radio Waves to Moisture changes

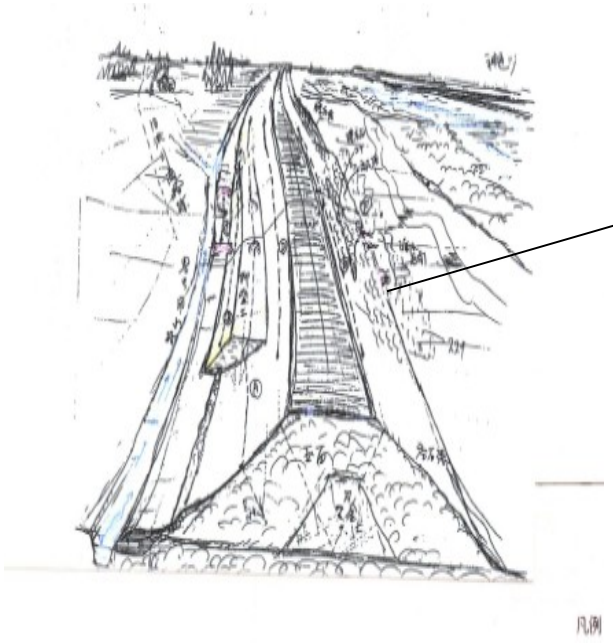


The Development of a Remote Levee Monitoring System

- Tank dimensions 8ft L x 4ft W x 4ft H
- Seven inch layer of gravel & 3
- Ported cables at 30” height with 20” betwee
- Resistivity Moisture Measurer
  - Surface
  - Along all Four sides

A full scale field test was initiated in 2007





Full Scale Field Test

- Ported cable
- Wrapped optic fiber
- Resistivity probes
- Temperature probes
- Moisture probes
- Well flow
- Weather station (Precipitation, humidity, wind speed)
- Information relayed to web via cell phone

- Ported cables from US Air Force surplus
- Levee District required procedure for installing cables without trenching
- Cooperative Research and Development Agreement (CRDA) Senstar-stellar Corporation and ERDC

Brunswick
© 2008 Europa Technologies
Image © 2008 DigitalGlobe
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Image © 2008 DigitalGlo
© 2008 Tele Atlas
32°31'14.65" N 91°05'06.42" W elev 92 ft
Streaming 100%

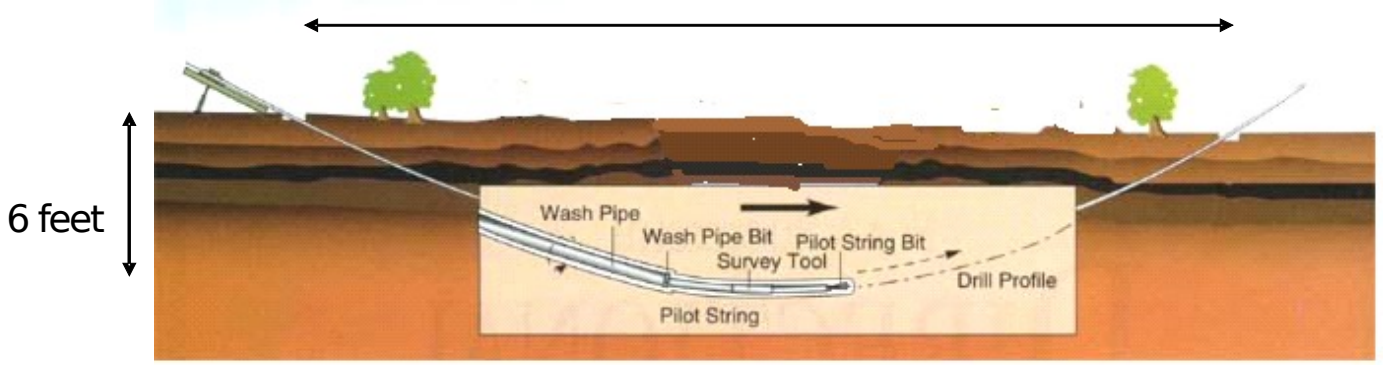
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
Pointer 32°31'14.07" N 91°04'23.69" W elev 89 ft
Streaming 100%
Eye alt 1476 ft
Google

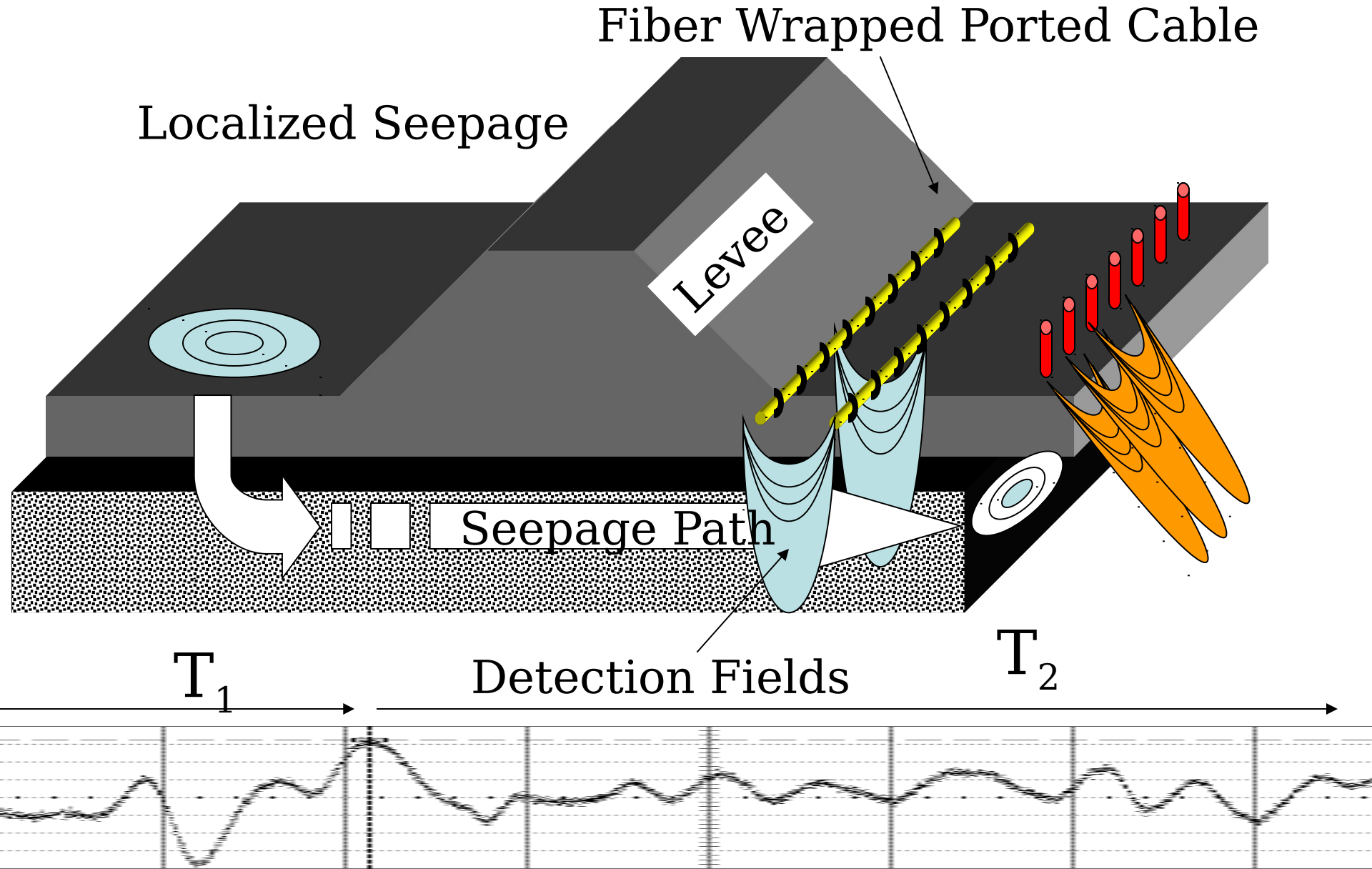
Directional Drilling was used to emplace the Ported Cable

Two Cables were put into the ground Four Feet Apart

Procedure:

- Inch PVC pipe was pulled through the Hole
- Ported Cable was feed through Pipe
- 2 inch pipe was removed leaving cable in contact with the Soil




Fiber Wrapped Ported Cable
Localized Seepage
Levee
Seepage Path
Detection Fields
T1
T2

Integrated Levee Assessment Utility

Remote Sensing/GIS Center of Expertise
Cold Regions Research & Eng. Lab
US Army Corps of Engineers
Engineer Research & Development Center

Data Tools

- Mapping
- Data Analysis
- Realtime Data
- Dataset Listing

Administration

Administration Panel

Realtime Data Viewer

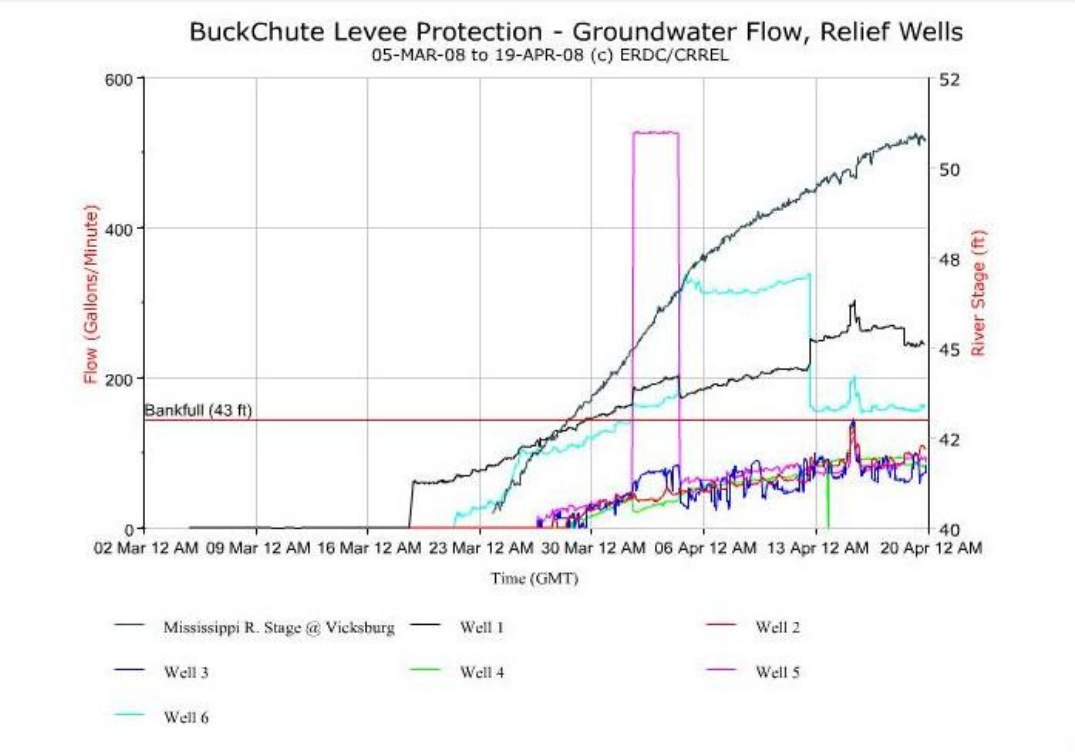
View Data As: Graph

Realtime Data Graph

Graph Format: Flash | Number of Days: 45 | End Date: 04/19/2008

Y Axis: Relief Wells | (Select all values between ☐ and ☐)

Display



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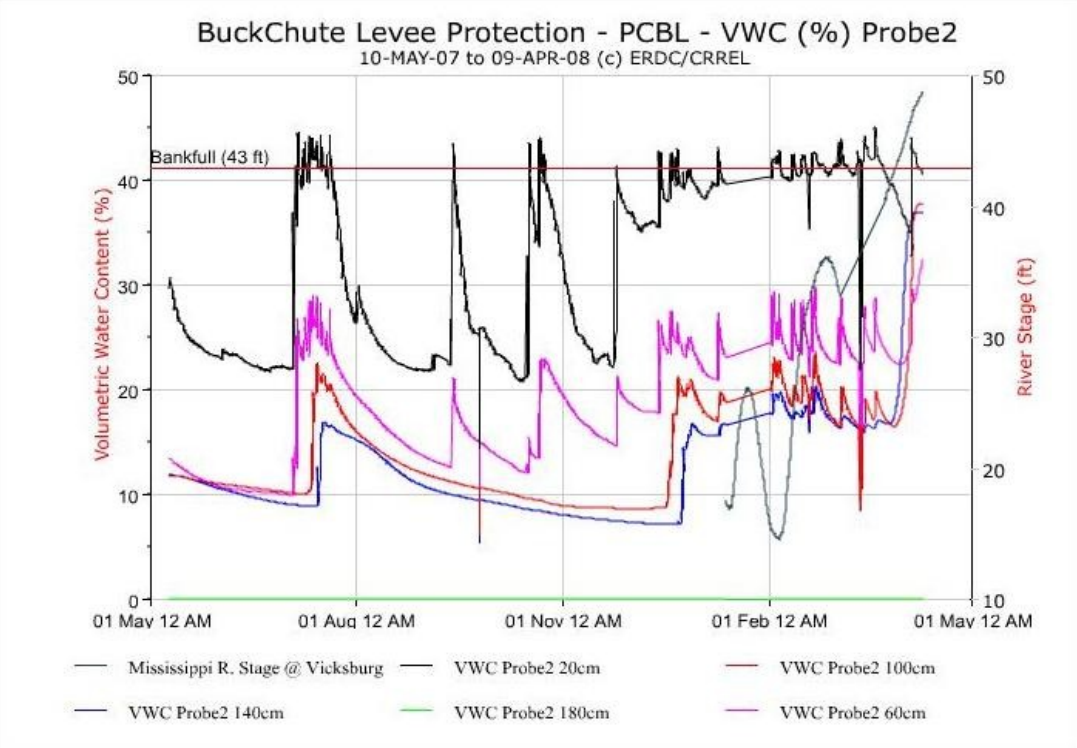
Realtime Data Graph

Graph Format: Flash | Number of Days: 335 | End Date: 04/09/2008

Y Axis: PCBL - VWC Probe 2 (Select all values between ☐ and ☐)

Display



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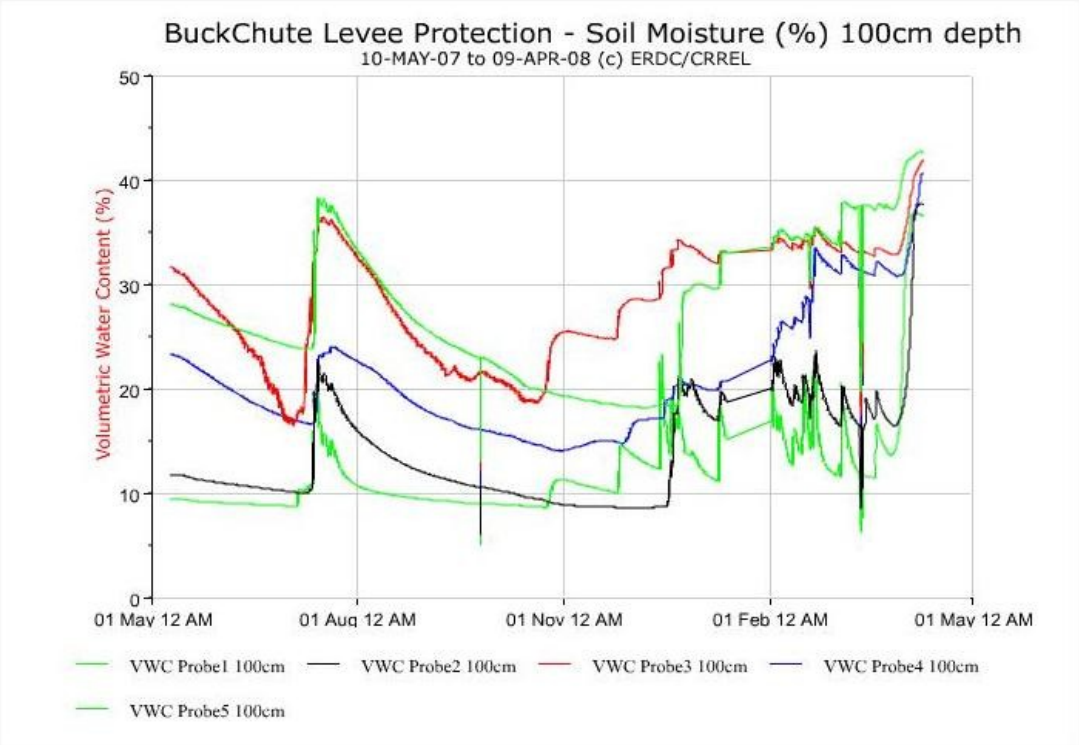
View Data As: Graph

Realtime Data Graph

Graph Format: Flash | Number of Days: 335 | End Date: 04/09/2008

Y Axis: PCBL - VWC Probes 100cm | (Select all values between ☐ and ☐)

Display



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Summary

- A low cost method is presented to monitor levees and evaluate health before, during, and after failure
- The ported cable and optic fiber can be placed in the levee before, during or after construction
- The ported cable concept is new, legacy systems (resistivity rods, moisture probes, are in place and are monitored real time)
- The cables will provide real-time information on seepage and any movement of the levee system.
- R&D is on-going, providing a solid understanding of costs versus benefits